Sun StorEdge™ 3000 Family
Best Practices Manual

Sun StorEdge 3510 FC Array

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Contents

Best Practices for the Sun StorEdge 3510 FC Array

This document highlights Fibre Channel (FC) best practices which apply to the Sun StorEdge™ 3510 FC array.

Overview

The Sun StorEdge 3510 array is a next generation Fibre Channel storage system designed to provide direct attached storage (DAS) to entry-level, mid-range, and enterprise servers, or to serve as the disk storage within a storage area network (SAN). This solution features powerful performance and reliability, availability and serviceability (RAS) features using modern FC technology. As a result, the Sun StorEdge 3510 FC array is ideal for performance sensitive applications and for environments with many entry-level, mid-range, and enterprise servers, such as:

- Internet
- Messaging
- Database
- Technical
- Imaging

This document gives a high level overview of the Sun StorEdge 3510 FC array and outlines four sample storage solutions for entry-level, mid-range, and enterprise servers. The Sun StorEdge 3510 FC array supports multiple servers, so these solutions are designed to match the overall environment rather than the particular applications running within it. Use them as-is or tailor them to fit your exact needs. Examples of customization opportunities include adding disks, enclosures and software or even combining configurations. Choosing the solution that best matches each particular environment will provide the best results.

Introduction

There are two popular methods for connecting storage to servers.

- The original and still most widely used approach uses a direct connection between a server and its storage system. A storage system connected in this manner is commonly referred to as direct-attached storage (DAS). The DAS solution of connecting each server to its own dedicated storage system is straightforward, and the absence of storage switches can minimize costs in some instances.

- A newer, more sophisticated technique places a storage switch between network servers and storage systems, creating what has become known as a Storage Area Network (SAN). In many ways, these two methods create contrasting storage architectures providing their own unique mix of benefits. A SAN solution shares a storage system among multiple servers using storage switches, and reduces the total number of storage systems required for a particular environment but increases the complexity.

Direct-Attached Storage (DAS)

Storage Area Network (SAN)
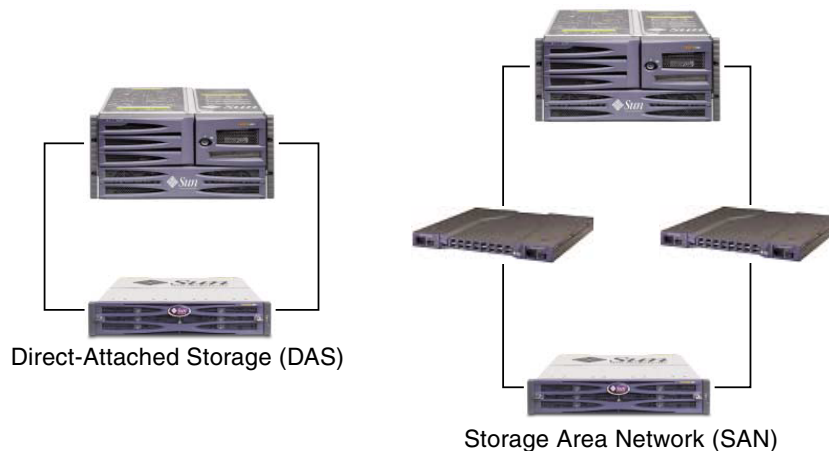
FIGURE 1   DAS and SAN Storage Architectures

Selecting the best storage architecture for a particular environment can be a confusing exercise. In general, some environments are well-suited for DAS while others will benefit greatly from SAN.

The challenge of selecting between DAS and SAN is often further complicated by the need to choose between different storage systems – one designed for DAS or another intended for SAN. Fortunately, every Sun StorEdge 3510 FC array inherently supports both DAS and SAN.

Overview

Fibre Channel Architecture

The Sun StorEdge 3510 FC array RAID controller has six fibre channels that can support 1 or 2 Gb data transfer speeds. RAID controller channels 0, 1, 4, and 5 are normally designated for connection to hosts or Fibre Channel switches. RAID controller channels 2 and 3 are dedicated drive channels.

In a dual RAID controller configuration, both RAID controllers have the same host channel designators, due to the architecture of the loops within the chassis. Each host channel of the top RAID controller shares a loop with the matching host channel on the bottom RAID controller. For example, channel 0 of the top RAID controller shares the same loop as channel 0 of the bottom RAID controller. This provides four distinct loops for connectivity with two ports per loop. The individual loops provide LUN failover without causing HBA path failover in the event of a controller failure.

Each I/O board has two ports designated as disk drive loops. These ports connect to the internal dual-ported Fibre Channel disk drives and are used to add expansion chassis to the configuration. The two drive loop ports on the upper I/O board form FC loop 2 while the two drive ports on the lower I/O board form FC loop 3. FC loop 2 provides a data path from both RAID controllers to the A loop of the internal disk drives, while FC loop 3 provides a data path from both RAID controllers to the B loop of the internal disk drives.

A single RAID controller configuration is slightly different. The lower I/O board has drive channels but does not have host channels. Overall, the same number of loops are available, but with half as many host channel ports.

Fibre Channel Protocols

The Sun StorEdge 3510 FC array supports point-to-point and Fibre Channel–Arbitrated Loops (FC–AL) protocols. Using the point-to-point protocol with the Sun StorEdge 3510 FC array requires a switched fabric network (SAN), whereas selecting FC-AL mode enables the array to be used in either DAS or SAN environments. Using point-to-point protocol enables full-duplex use of the available channel bandwidth, whereas selecting FC-AL mode limits host channels to half-duplex mode.

In a point-to-point configuration, only one ID can be assigned to each host channel. If more than one ID is assigned, the point-to-point protocol rules are violated. Any host channel with more than one ID will not be able to log in to an FC switch in fabric mode. This "one-ID-per-channel" requirement is true in both single-controller and dual- controller configurations. Thus, in dual-controller configurations, either the primary or the secondary controller can have an ID assigned, but not both. This yields:

(4 host channels) X (1 ID per channel) X (32 LUNs per ID) = 128 maximum addressable LUNs in a fabric point-to-point environment. If dual paths are desired for each logical device, a maximum of 64 dual-pathed LUNs are available.

In an FC-AL configuration, multiple IDs can be assigned to any given host channel. Although it is possible to add more, it is preferable that no more than four IDs be assigned to a controller on a given host channel. Thus no more that eight IDs should be assigned to any host channel if both primary and secondary controllers each have four IDs. This yields (4 host channels) X (8 IDs per channel) X (32 LUNs per ID) = 1024 maximum addressable LUNs in a FC-AL environment. However, configuring the maximum number of LUNs increases overhead and can have a negative impact on performance.

The FC-AL protocol should be selected for environments needing more than 128 LUNs, or where a switched fabric network is not available.

Supported RAID Levels

There are several RAID level choices: RAID 0, 1, 3, 5, 1+0 (10), 3+0 (30), and 5+0 (50). RAID levels 1, 3, and 5 are the most commonly used. The Sun StorEdge 3510 FC array supports the use of both global and local spare drives in the unlikely event of disk failure. It is good practice to use spare drives when configuring RAID devices. Refer to the *Sun StorEdge 3000 Family RAID Firmware 3.27 User's Guide, Sun StorEdge 3510 FC Array* (P/N 816-7934) for detailed information on how RAID levels and spare drives are implemented.

Logical Drives

A logical drive (LD) is a group of physical drives configured with a RAID level. Each LD can be configured for a different RAID level.

The Sun StorEdge 3510 FC array supports a maximum of eight LDs. A LD can be managed by either the primary or secondary controller. The best practice for creating LDs is to split them evenly across the primary and secondary controllers. The most efficient maximum configuration would have four LDs assigned to each controller.

With at least one LD assigned to each controller, both controllers are active. This configuration is known as an active-active controller configuration and allows maximum use of a dual controller array's resources.

Each LD can be partitioned in up to 128 separate partitions or used as a single partition. The partitions are presented to the host as LUNs.

Once the LDs have been created, assigned to a controller, and partitioned, the partitions must be mapped to host channels as LUNs in order for them to be seen by a host. It is usually desirable to map each partition to two host channels for redundant pathing.

A partition can only be mapped to a host channel where its controller has an assigned ID. For example, if LD 0 is assigned to the primary controller, all partitions on LD 0 will need to be mapped to a host channel ID on the primary controller (PID). Any LDs assigned to the secondary controller will need to have all partitions mapped to a host channel ID on the secondary controller (SID).

When attaching fibre cables for LUNs configured with redundant paths, make sure one cable is connected to an upper port channel and the other cable is connected to a different channel on the lower controller. Then, if multipathing software is configured on the host, a controller can be hot-swapped in the event of failure without losing access to the LUN.

For example, suppose partition 0 of LD0 is mapped to Channel 0 PID 42 and Channel 5 PID 47. To ensure that there is no single point of failure (SPOF), connect a cable from the host HBA or a switch port to the upper board port FC0, and connect a second cable from the lower board port FC5 to a different host HBA or switch.

Cache Optimization

The Sun StorEdge 3510 FC array can optimize the RAID devices for either sequential I/O or random I/O. Sequential I/O is the default setting.

The sequential optimization mode reads and writes data in large 128K blocks, in order to transfer information more efficiently for the kinds of applications most often employed. The logical drive, cache memory, and other controller internal parameters are adjusted for high throughput use such as video and imaging applications. The maximum allowable size of a logical drive optimized for sequential I/O is 2 terabytes (TB).

The random I/O optimization mode reads and writes data in small 32K blocks. When using random I/O optimization mode, the logical drive, cache memory, and other controller parameters are adjusted for the use of database/transaction-processing applications. The maximum allowable size of a logical drive optimized for random I/O is 512 GB. This limit constrains the number of disks that can be included in a logical drive.

Numerous controller parameters are also changed to optimize for sequential or random I/O. The change takes effect after the controller resets. Sequential or random optimization must be set prior to creating logical drives.

There are two limitations that apply to the optimization modes.

- One optimization mode must be applied to all logical drives in a RAID array.
- Once the optimization mode is selected and logical drives are created, the optimization mode of those logical drives cannot be changed. The only way to change the optimization mode is to delete all logical drives, select the new optimization mode, reboot the array, and create new logical drives. Any existing data on the logical drives is lost during this procedure, which is why it is important to correctly select the optimization mode early in the planning process.

Array Management Tools

The Sun StorEdge 3510 FC array can be configured and monitored through any of the following methods:

- Using the out-of-band serial port connection, a Solaris tip session or terminal emulation program for other supported operating systems can be used to access the Sun StorEdge 3510 FC array's internal firmware application. All procedures can be performed by using the firmware's terminal interface via the COM port.

- In-band configuration options from a host system include the Sun StorEdge Configuration Service software or the command-line interface (CLI). Refer to the *Sun StorEdge 3000 Family Configuration Service User's Guide* (P/N 816-7931) for information about how to set up and use of the Configuration Service software package. The CLI is installed as part of the SUNWsccli package. The main advantages of the CLI are that commands can be scripted and information can be passed to other programs. Information on CLI functionality can be found in the sccli man page once the package is installed.

- Using the out-of-band Ethernet port connection, telnet can be used to access the firmware application. All procedures except the initial assignment of an IP address can be done through an Ethernet port connection. Refer to the *Sun StorEdge 3000 Family Installation, Operation and Service Manual for the Sun StorEdge 3510 FC Array* (P/N 816-7300) and the *Sun StorEdge 3000 Family Configuration Service User's Guide* (P/N 816-7931) for detailed information about using out-of-band management tools.

Caution – If you assign an IP address to an array in order to manage it out-of-band, for security reasons make sure that the IP address is on a private network, rather than a publicly routable network.

There are two main reasons for placing your arrays on a private subnet:

- When your array is on a public network, it is susceptible to viruses, worms, and other malware attacks.

- A variety of security software is available to detect and mitigate these attacks. Some port-scanning and other security software can have an adverse impact on your ability to access data. In extreme cases, some of this software can cause Sun StorEdge 3000 Family arrays to hang.

Since it is not possible to predict the side-effects of all current and future security software products, place your Sun StorEdge 3310 SCSI arrays and Sun StorEdge 3510 FC arrays on private subnets.

Saving and Restoring Configuration Information

An important feature of these management tools is the ability to save and restore configuration information in a number of ways. Using the Sun StorEdge 3510 FC array firmware, the configuration information (NVRAM) can be saved to disk. This provides a backup of the controller-dependent configuration information such as channel settings, host IDs, FC protocol, and cache configuration. It does not save LUN mapping information.   The NVRAM configuration file can restore all configuration settings but does not rebuild logical drives.

The Configuration Service software can be used to save and restore all configuration data, including LUN mapping information. It can be used to rebuild all logical drives and therefore can be used to completely duplicate an array configuration to another array.

Direct-Attached Storage

One powerful feature of Sun StorEdge 3510 FC arrays is their ability to support multiple direct-attached servers without requiring storage switches. They accomplish this using intelligent internal Fibre Channel networks. Servers can be directly connected using built-in external Fibre Channel ports, if available, or add-in Fibre Channel host adapter cards. The Sun StorEdge 3510 FC array automatically configures its ports to match the transfer speed and communication method of each connection.

Standard DAS Configuration   High Availability DAS Configuration
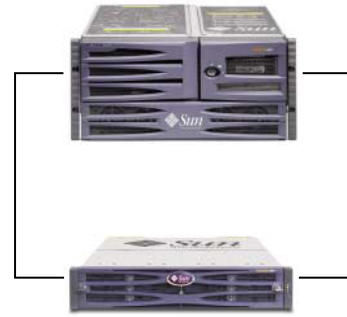
FIGURE 2   Two DAS Configurations

The actual number of servers that can be connected varies according to the number of Sun StorEdge 3510 FC array controllers. It also depends on the quantity of Fibre Channel connections used for each server and the total number of small form-factor pluggable (SFP) interface modules installed. DAS configurations often include single or dual servers only, though a dual-controller Sun StorEdge 3510 FC array can support up to four servers with redundant connections, or eight servers in non-redundant DAS configurations by adding SFP modules.

Storage Area Networking

Introducing storage switches to a Sun StorEdge 3510 FC array configuration creates a SAN, increasing the number of servers that can be connected. Essentially, the maximum number of servers that can be connected to the SAN becomes equal to the number of available storage switch ports. Storage switches generally include the ability to manage and monitor the Fibre Channel networks they create, which can reduce storage management workloads in multiple server environments.

The Sun StorEdge 3510 FC is designed to be deployed in SANs based on switched Fibre Channel fabrics. In a SAN scenario, the server HBAs are connected to one side of the fabric and storage is connected to the other. A SAN fabric automatically routes Fibre Channel packets between ports on one or many Fibre Channel switches.

SAN deployment enables the Sun StorEdge 3510 FC to be used by a larger number of hosts. This storage strategy tends to utilize storage resources more effectively and is commonly referred to as *storage consolidation.*

The number of hosts that can effectively share one Sun StorEdge 3510 FC depends on several factors, such as the type of host application, bandwidth requirements, and the need for concurrent IOPs. Since most applications have moderate performance needs, it is quite feasible to have several hosts sharing the same Sun StorEdge 3510 FC controller.

The SAN can also support multiple Sun StorEdge 3510 FC arrays. Increasing the number of StorEdge arrays makes more performance and capacity available within the storage network for sharing among the servers connected to the SAN. A SAN also provides great flexibility in how storage capacity can be allocated among servers and eliminates cabling changes when reallocation of storage becomes necessary.

When the Sun StorEdge 3510 FC is deployed in a SAN, both point-to-point (full fabric) and arbitrated loop (public loop) modes are supported. Point-to-point mode allows for slightly better full duplex performance but limits the total number of addressable LUNs to 128, or to 64 when redundant pathing is used.

Scaling Capacity

The Sun StorEdge 3510 FC array is available in a number of configurations to address a broad range of storage capacities. Base systems include single or redundant controllers and a choice of five or twelve disks. This results in storage capacities as small as 180 GB with five 36-GB disks and as large as 1.75 TB with twelve 146-GB disks in a single Sun StorEdge 3510 FC array.

Additional storage capacity can be dynamically created, starting with a system with five disks and then adding one or more disks. Expansion units can be dynamically added to base systems when more storage capacity is required than a single Sun StorEdge 3510 FC array can provide.

Sun StorEdge 3510 FC arrays remain a single storage system as expansion units are added, even though there are multiple interconnected physical units. Expansion units simply add bays to base units to increase the total number of disks that can be supported. A fully configured system can support as many as thirty-six disks using one base unit and two expansion units, providing a maximum storage capacity of 5.25 TB using 146-GB disks.

Up to 12 disks   Up to 24 disks   Up to 36 disks

Scalability
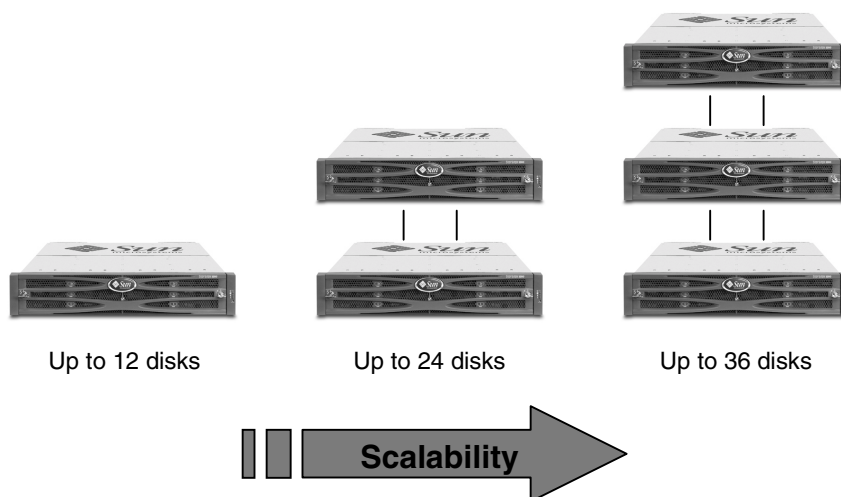
FIGURE 3   Increasing Capacity

First Steps

There are two simple yet effective approaches for designing a Sun StorEdge 3510 FC array solution into your environment. Both methods allow for the rapid estimation of an appropriate DAS or SAN solution. Regardless of which method is used, the storage needs of each application and server involved must be identified to establish the total amount of storage capacity required.

The first method works well for existing environments. Start by identifying the number of servers that can immediately benefit from the Fibre Channel storage the Sun StorEdge 3510 FC array provides. For five or more servers, a SAN solution can provide the necessary connectivity to support them all. If there are four or fewer servers, a DAS solution is sufficient, though a SAN solution remains a powerful option. Determine the amount of storage currently accessible to these servers and plan for that total capacity as the minimum amount of Sun StorEdge 3510 FC array capacity needed.

Another technique involves matching a particular environment to one of the Sun StorEdge 3510 FC array best practices solutions described in this document. This approach works particularly well with new deployments, but it can be used for existing environments as well. Compare the total number of servers in each solution. Take notice of special features, such as the number of connections between servers and storage. While these solutions do not match every environment exactly, use the closest one as a design blueprint that can be customized to suite your particular

environment. For environments with different server configurations, choose the solution that best matches the servers whose applications are mission-critical or most important.

General Configuration Considerations

The entry-level configuration for an FC array uses only one RAID controller. If this configuration is used, two single-controller arrays should use host-based mirroring to ensure high reliability, availability, and serviceability (RAS).

It is preferable to use dual-controller arrays to avoid a single point of failure. A dual-controller FC array features a default active-to-active controller configuration. This configuration provides high reliability and high availability because, in the unlikely event of a controller failure, the array automatically fails over to a second controller, resulting in no interruption of data flow.

The Sun StorEdge 3510 FC array is extremely flexible, but when designing storage solutions remember to keep them as simple as possible. Keep the following suggestions in mind when designing the configuration of a Sun StorEdge 3510 FC storage system:

- Prior to creating logical drives and mapping them to host channels, set the appropriate cache optimization, Fibre Channel protocol and controller channel IDs. Reset the controller after these configuration parameters have been set.
- For best performance and RAS, create logical drives across expansion units.
- Use either local or global spare drives when creating logical drives. Any free drive can be designated as a spare and more than one drive can be used as a spare.
- Use dual pathing for each LUN and use Sun StorEdge Traffic Manager software to provide load balancing across controller ports for increased performance.
- The maximum number of LUNs when using point-to-point protocol is 128 for single- path configurations and 64 for dual-path configurations.
- After completing the configuration of the Sun StorEdge 3510 FC array, the configuration should be saved using the firmware "save nvram to disks" menu option and the Sun StorEdge Configuration Service Console's "save configuration" utility.

Non-Redundant DAS Configurations

Note – Using single connections between Sun StorEdge 3510 SCSI arrays and servers creates single points of failure (SPOF) that can cause interruptions in the event a connection becomes unreliable or fails. This is not a recommended configuration unless host-based mirroring is utilized to protect against single points of failure.
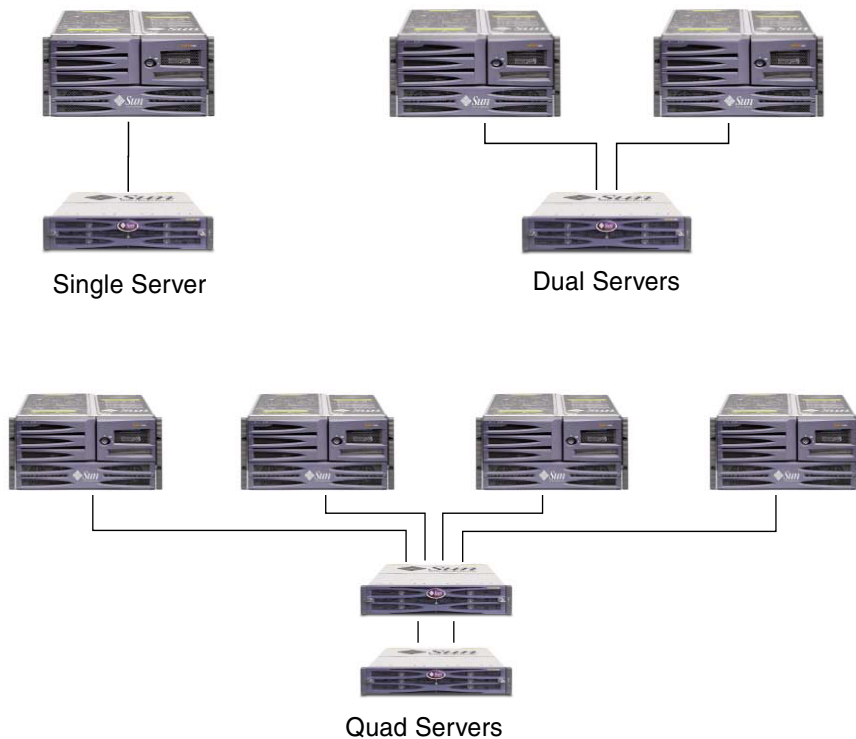

Single Server

Dual Servers

Quad Servers

FIGURE 4   Three Non-Redundant DAS Configurations

TABLE 1   Configuration Overview for Non-Redundant DAS

	Single Server Configurations	Dual Server Configurations	Quad Server Configurations
Number of Servers	1	2	4
RAID Enclosures	1	1	1
Expansion Units	As needed	As needed	One or more
Number of Controllers	1	1	1
Number of Disks	5 or more	12 or more	24 or more
Cache Optimization	Random or sequential	Random or sequential	Random or sequential
RAID Levels	Application-dependent	Application-dependent	Application-dependent
Fibre connection option	Loop only	Loop only	Loop only
Drive configuration	One or more logical drives plus one global spare	Two or more logical drives plus one global spare	Four or more logical drives plus one global spare
Disk Configuration	One or more logical drives plus one global spare	Two or more logical drives plus one global spare	Four or more logical drives plus one global spare
Host Adapters per server	Single-Port 2-Gbit FC	Single-Port 2-Gbit FC	Single-Port 2-Gbit FC
Traffic Manager	Not required	Not required	Not required
Storage Switches	Not required	Not required	Not required

Non-Redundant DAS Tips and Techniques

- A Sun StorEdge 3510 FC array with a single controller can be configured to support up to four host connections. These connections can be used in pairs, individually, or in any combination of both.

- You will need to add SFP modules to support more than four host connections to the Sun StorEdge 3510 array. Add one SFP module to support three connections and add two SFP modules to support four connections.

- Using two single-port FC host bus adapters (HBAs) or a dual-port 2-Gbit FC HBA in single-server or dual-server configurations makes optimum use of the Sun StorEdge 3510 FC array's performance. Mapping logical drive partitions to two paths while using multipathing software and load balancing provides the best performance.

Non-Redundant DAS Setup Details
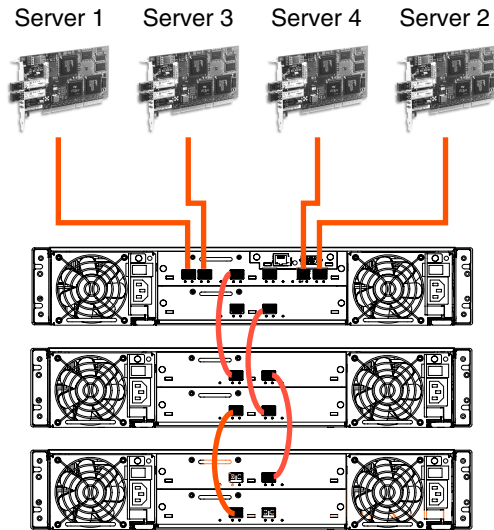
FIGURE 5   Non-Redundant DAS Connections

TABLE 2   Setup Summary for Non-Redundant DAS

Channel Number	Primary ID Number	Secondary ID Number
0	40	N/A
1	43	N/A
2	14	N/A
3	14	N/A
4	44	N/A
5	47	N/A

The general procedure for creating this configuration follows.

1. **Check the position of installed SFP modules. Move or add SFP modules as necessary to support the connections needed.**

2. **Connect expansion units if needed.**

3. **Configure cache optimization**

4. **Create one Logical Drive for each server and configure spare disks.**

5. **Map Logical Drive 0 to controller channel 0.**

6. **Map Logical Drive 1 (if created) to controller channel 5.**

7. **Map Logical Drive 2 (if created) to controller channel 1.**

8. **Map Logical Drive 3 (if created) to controller channel 4.**

9. **Connect the first server to upper controller port 0.**

10. **Connect the second server (if needed) to controller port 5.**

11. **Connect the third server (if needed) to controller port 1.**

12. **Connect the fourth server (if needed) to controller port 4.**

High-Availability DAS Configurations
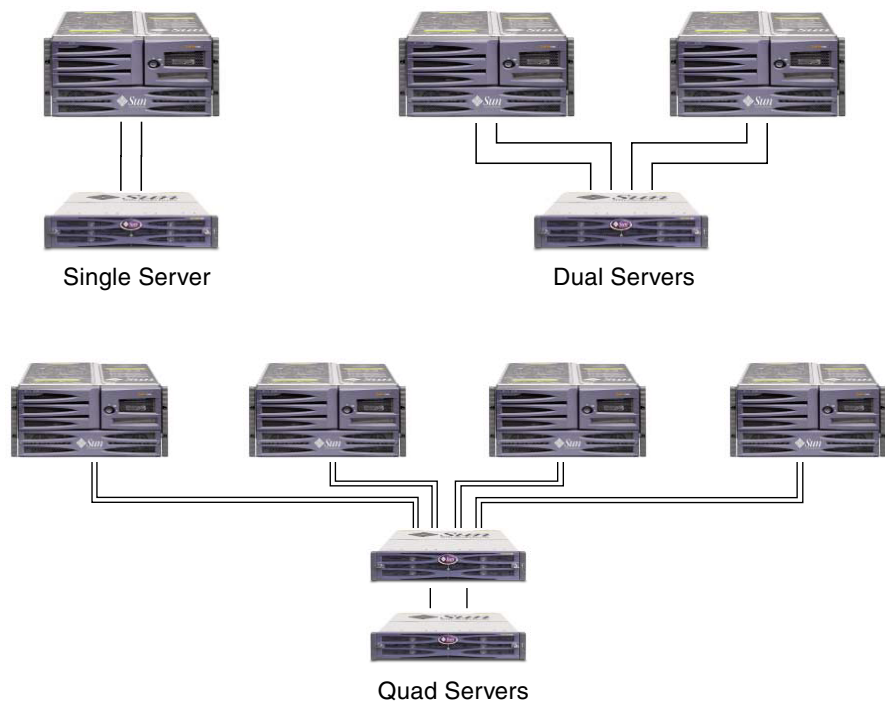
FIGURE 6   High-Availability DAS Configurations

TABLE 3   Configuration Overview for High Availability DAS

	Single Server Configurations	Dual Server Configurations	Quad Server Configurations
Number of Servers	1	2	4
RAID Enclosures	1	1	1
Expansion Units	As needed	As needed	One or more
Number of Controllers	2	2	2
Number of Disks	5 or more	12 or more	24 or more
Cache Optimization	Random or sequential	Random or sequential	Random or sequential
RAID Levels	Application-dependent	Application-dependent	Application-dependent
Fibre connection option	Loop only	Loop only	Loop only
Dive Configuration	One or more logical drives plus one global spare	Two or more logical drives plus one global spare	Four or more logical drives plus one global spare
Host Adapters per server	Two Single-Port 2-Gbit FC	Two Single-Port 2-Gbit FC	Two Single-Port 2-Gbit FC
Traffic Manager	Required	Required	Required
Storage Switches	Not required	Not required	Not required

High-Availability DAS Tips and Techniques

- A Sun StorEdge 3510 FC array with two controllers can be configured to support up to eight host connections. These connections can be used in pairs for redundancy, individually or in any combination of both.

- You will need to add SFP modules to support more than four host connections to the Sun StorEdge 3510 array. For example, add two SFP modules to support six connections and add four SFP modules to support eight connections.

- Using two single-port 2-Gbit FC host adapters in a high-availability configuration will make optimum use of the Sun StorEdge 3510 FC array's redundancy. Mapping logical drive partitions to two paths while using multipathing software provides the best redundancy.

- For complete redundancy and high availability, use multipathing software such as Sun StorEdge Traffic Manager. To configure multipathing:

  - Establish two connections between a server and a Sun StorEdge 3510 FC array.

  - Install and enable the software on the server.

  - Map the logical drive to both of the controller channels to which the server is connected.

High-Availability DAS Setup Details
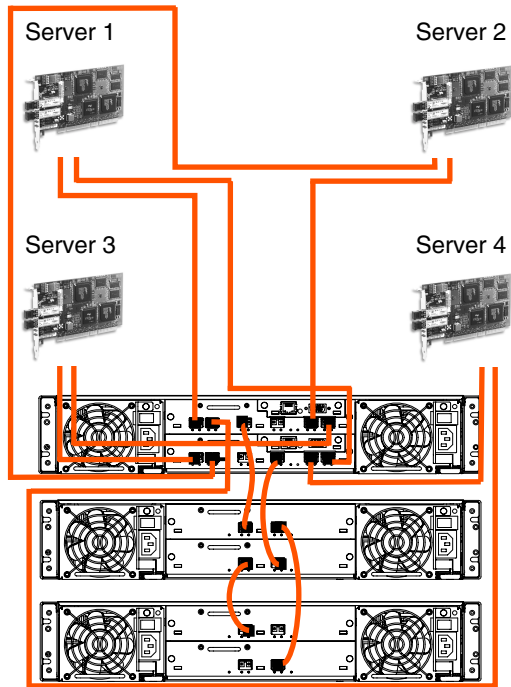
FIGURE 7   High-Availability DAS Connections

TABLE 4   Setup Summary for High-Availability DAS

Channel Number	Primary ID Number	Secondary ID Number
0	40	41
1	43	42
2	14	15
3	14	15
4	44	45
5	47	46

The general procedure for creating this configuration follows.

1. **Check the position of installed SFP modules. Move them as necessary to support the connections needed.**

2. Connect expansion units if needed.

3. Configure cache optimization.

4. Ensure fibre connection is set to loop mode.

5. Configure target IDs.

6. Create one Logical Drive for each server and configure spare disks.

7. Map Logical Drive 0 to channels 0 and 5 of the primary controller.

8. Map Logical Drive 1 (if created) to channels 1 and 4 of the secondary controller.

9. Map Logical Drive 2 to channels 0 and 5 of the primary controller

10. Map Logical Drive 3 (if created) to channels 1 and 4 of the secondary controller.

11. Connect the first server to port 0 of the upper controller and port 5 of the lower controller.

12. Connect the second server (if needed) to port 1 of the lower controller and port 4 of the upper controller.

13. Connect the third server (if needed) to port 0 of the lower controller and port 5 of the upper controller.

14. Connect the fourth server (if needed) to port 1 of the upper controller and port 4 of the lower controller.

15. Install and enable multipathing software on each connected server.

Full-Fabric SAN Configurations
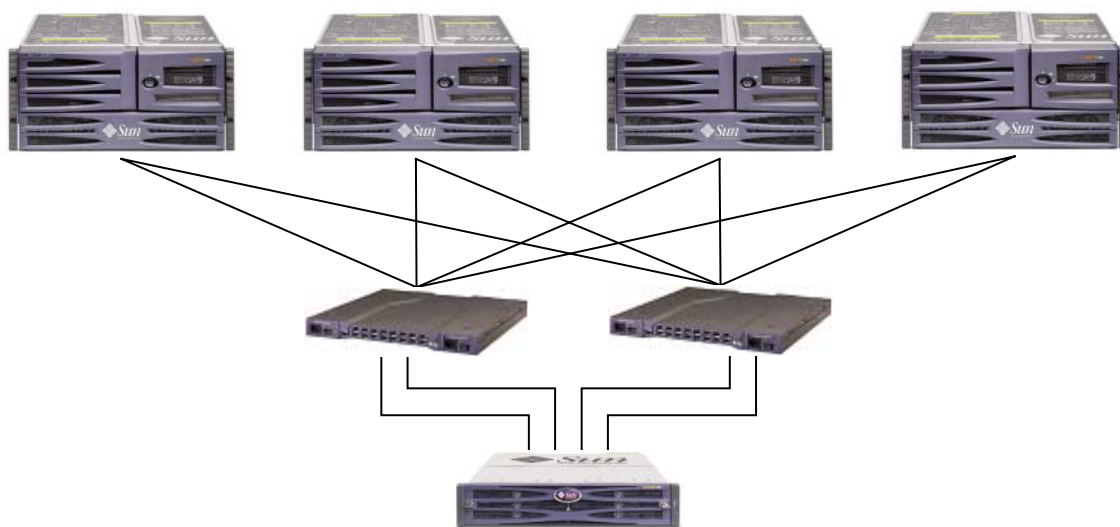
FIGURE 8   Typical Full-Fabric SAN Configuration

TABLE 5   Configuration Overview for a Full-Fabric SAN

	Small Configuration	Medium Configuration	Large Configuration
Number of Servers	2 to 4	2 to 14	2 to 62
RAID Enclosures	1	1	1
Expansion Units	As needed	As needed	As needed
Number of Controllers	2	2	2
Number of Disks	12 or more	12 or more	12 or more
Cache Optimization	Random or sequential	Random or sequential	Random or sequent
RAID Levels	Application-dependent	Application-dependent	Application-dependent
Fibre connection option	Point-to-point	Point-to-point	Point-to-point
Drive Configuration	Two LUNs with two global spares	Two LUNs with two global spares	Two LUNs with two global spares

TABLE 5	Configuration Overview for a Full-Fabric SAN *(Continued)*		
Host Adapters per server	Dual-port 2-Gbit FC	Dual-port 2-Gbit FC	Dual-port 2-Gbit FC
Traffic Manager	Required	Required	Required
Storage Switches	Two 8-port 2-Gbit FC fabric switches	Two 16-port 2-Gbit FC fabric switches	Two 32-port 2-Gbit FC fabric switches

Full-Fabric SAN Tips and Techniques

- In the fabric SAN configuration, the switches communicate with the Sun StorEdge 3510 FC array host ports using a fabric point-to-point (F_port) mode. This enables transparent controller fail-over and fail-back without server-resident software. However, supporting hot-swap servicing of a failed controller requires the use of multipathing software, such as the Sun StorEdge Traffic Manager, on the connected servers.

- Use of fabric point-to-point (F_port) connections between a Sun StorEdge 3510 FC array and fabric switches limits to 128 the total number of LUNs that can be presented. Fibre channel standards allow only one ID per port when operating point-to-point protocols, resulting in a maximum of four IDs, with a maximum of 32 LUNs each, supporting up to 128 LUNs.

Full-Fabric SAN Setup Details

The following example applies to a dual-controller array in a point-to-point configuration.
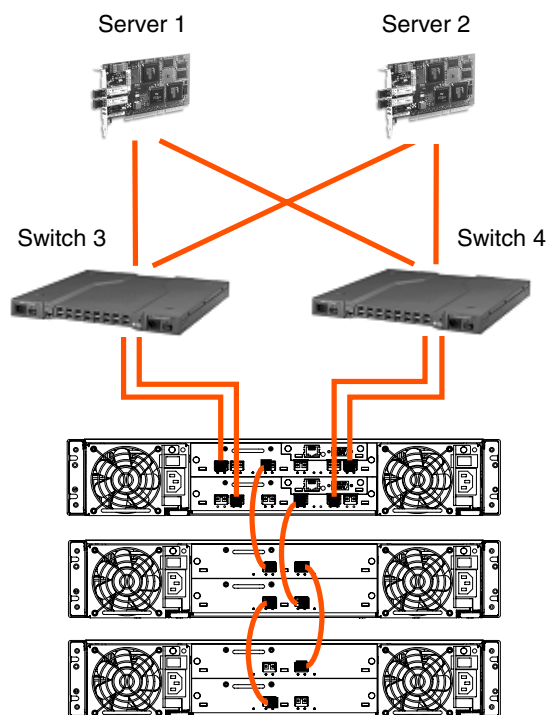
Diagram showing a full-fabric SAN configuration

FIGURE 9   Full-fabric SAN connections

TABLE 6   Setup Summary for Full Fabric SAN

Channel Number	Primary ID Number	Secondary ID Number
0	40	N/A
1	N/A	42
2	14	15
3	14	15
4	44	N/A
5	N/A	46

The general procedure for creating this configuration follows.

1. **Check the position of installed SFP modules. Move them as necessary to support the connections needed.**

2. **Connect expansion units if needed.**

3. **Configure cache optimization**

4. **Ensure fibre connection option is set to point-to-point.**

5. **Ensure only one target ID per channel is configured.**

6. **Create at least two logical drives and configure spare disks.**

7. **Create one or more logical drive partitions for each server.**

8. **Map Logical Drive 0 to channels 0 and 4 of the primary controller**

9. **Map Logical Drive 1 to channels 1 and 5 of the secondary controller.**

10. **If more than two logical drives were created, map even-numbered logical drives to channels 0 and 4 of the primary controller and odd-numbered logical drives to channels 1 and 5 of the secondary controller.**

11. **Connect the first switch to port 0 of the upper controller and port 1 of the lower controller.**

12. **Connect the second switch to port 4 of the lower controller and port 5 of the upper controller.**

13. **Connect each server to each switch.**

14. **Install and enable multipathing software on each connected server.**
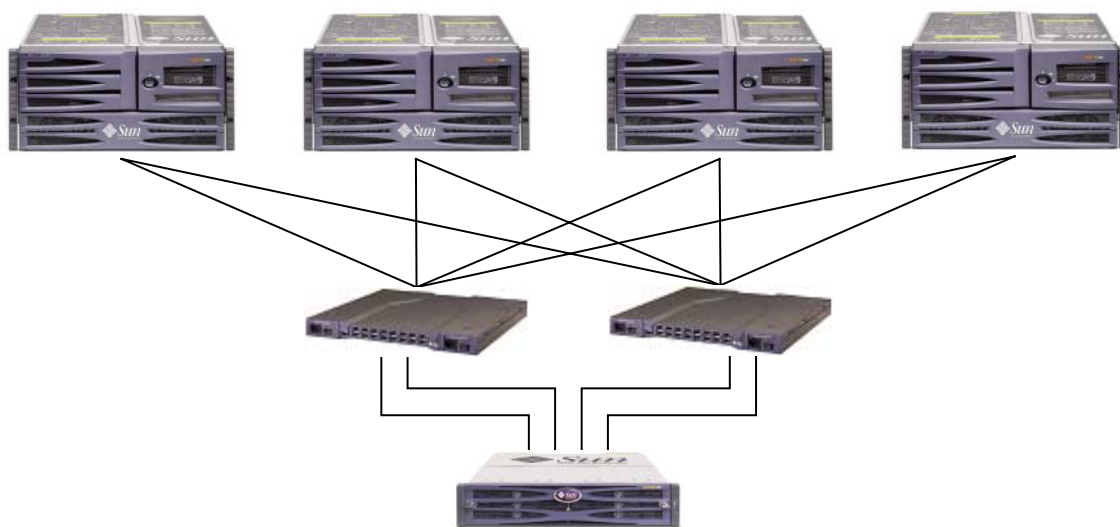
High-Performance SAN Configurations

FIGURE 10 Typical High-Performance SAN Configurations

TABLE 7 Configuration Overview for High-Performance SAN

	Small Configuration	Medium Configuration	Large Configuration
Number of Servers	2 to 4	2 to 14	2 to 62
RAID Enclosures	1	1	1
Expansion Units	As needed	As needed	As needed
Number of Controllers	2	2	2
Number of Disks	12 or more	12 or more	12 or more
Cache Optimization	Random or sequential	Random or sequential	Random or sequential
RAID Levels	Application-dependent	Application-dependent	Application-dependent
Fibre connection option	Loop only	Loop only	Loop only
Drive Configuration	Two LUNs with two global spares	Two LUNs with two global spares	Two LUNs with two global spares

	Small Configuration	Medium Configuration	Large Configuration
Host Adapters per server	Dual-port 2-Gbit FC	Dual-port 2-Gbit FC	Dual-port 2-Gbit FC
Traffic Manager	Required	Required	Required
Storage Switches	Two 8-port 2-Gbit FC fabric switches	Two 16-port 2-Gbit FC fabric switches	Two 32-port 2-Gbit FC fabric switches

High-Performance SAN Tips and Techniques

- In the high-performance SAN configuration, the switches communicate with the Sun StorEdge 3510 FC array host ports using a fabric loop (FL_port) mode. This enables every Fibre Channel host connection within the Sun StorEdge 3510 FC array to send and receive data from servers, resulting in optimum performance.
- Use of fabric loop (FL_port) connections between a Sun StorEdge 3510 FC array and fabric switches enables up to 1024 total LUNs to be presented to servers. However, using such a large number of LUNs adversely affects performance.

High-Performance SAN Setup Details

The following example applies to a dual-controller array in a loop configuration.
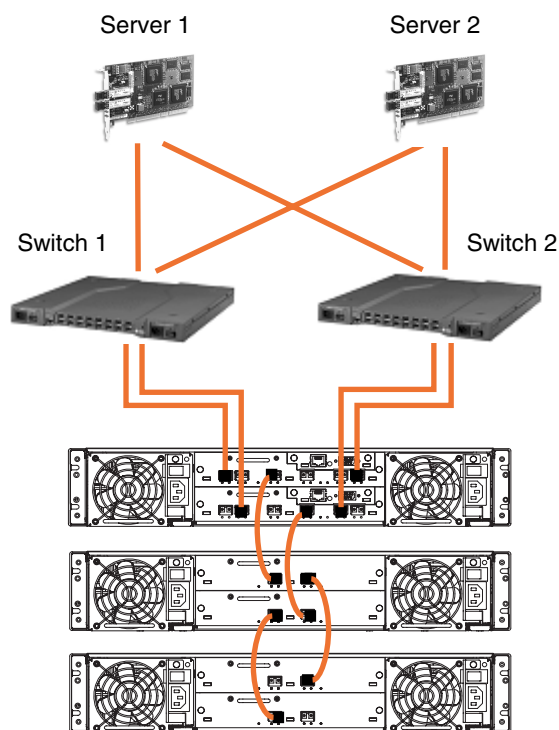
Diagram showing high-performance SAN connections

FIGURE 11   High-Performance SAN Connections

TABLE 8   Setup Summary for a High-Performance SAN

Channel Number	Primary ID Number	Secondary ID Number
0	40	41
1	43	42
2	14	15
3	14	15
4	44	45
5	47	46

The general procedure for creating this configuration follows.

1. **Check the position of installed SFP modules. Move them as necessary to support the connections needed.**

2. **Connect expansion units if needed.**

3. **Configure cache optimization.**

4. **Ensure fibre connection option set to loop mode.**

5. **Configure target IDs.**

6. **Create at least two logical drives and configure spare disks.**

7. **Create one or more logical drive partitions for each server.**

8. **Map Logical Drive 0 to channels 0, 1, 4 and 5 of the primary controller**

9. **Map Logical Drive 1 to channels 0, 1, 4 and 5 of the secondary controller.**

10. **If more than two logical drives were created, map even-numbered logical drives to channels 0, 1, 4 and 5 of the primary controller and odd-numbered logical drives to channels 0, 1, 4 and 5 of the secondary controller.**

11. **Connect the first switch to port 0 of the upper controller and port 1 of the lower controller.**

12. **Connect the second switch to port 4 of the lower controller and port 5 of the upper controller.**

13. **Connect each server to each switch.**

14. **Install and enable multipathing software on each connected server.**

Summary

Entry-level, mid-range, and enterprise servers are used for a wide range of applications with distinct storage requirements, so the Sun StorEdge 3510 FC array features a modular architecture with flexible configurations. For example, a solution can be deployed as direct-attached storage (DAS) or as part of a storage area network (SAN). Configuration preferences include RAID protection levels, single or redundant controllers, total storage capacity, multipathing and more.

Modularity and flexibility allow Sun StorEdge 3510 FC array storage solutions to be quickly and easily adapted to a particular environment.